FIG. 1A
Prior Art

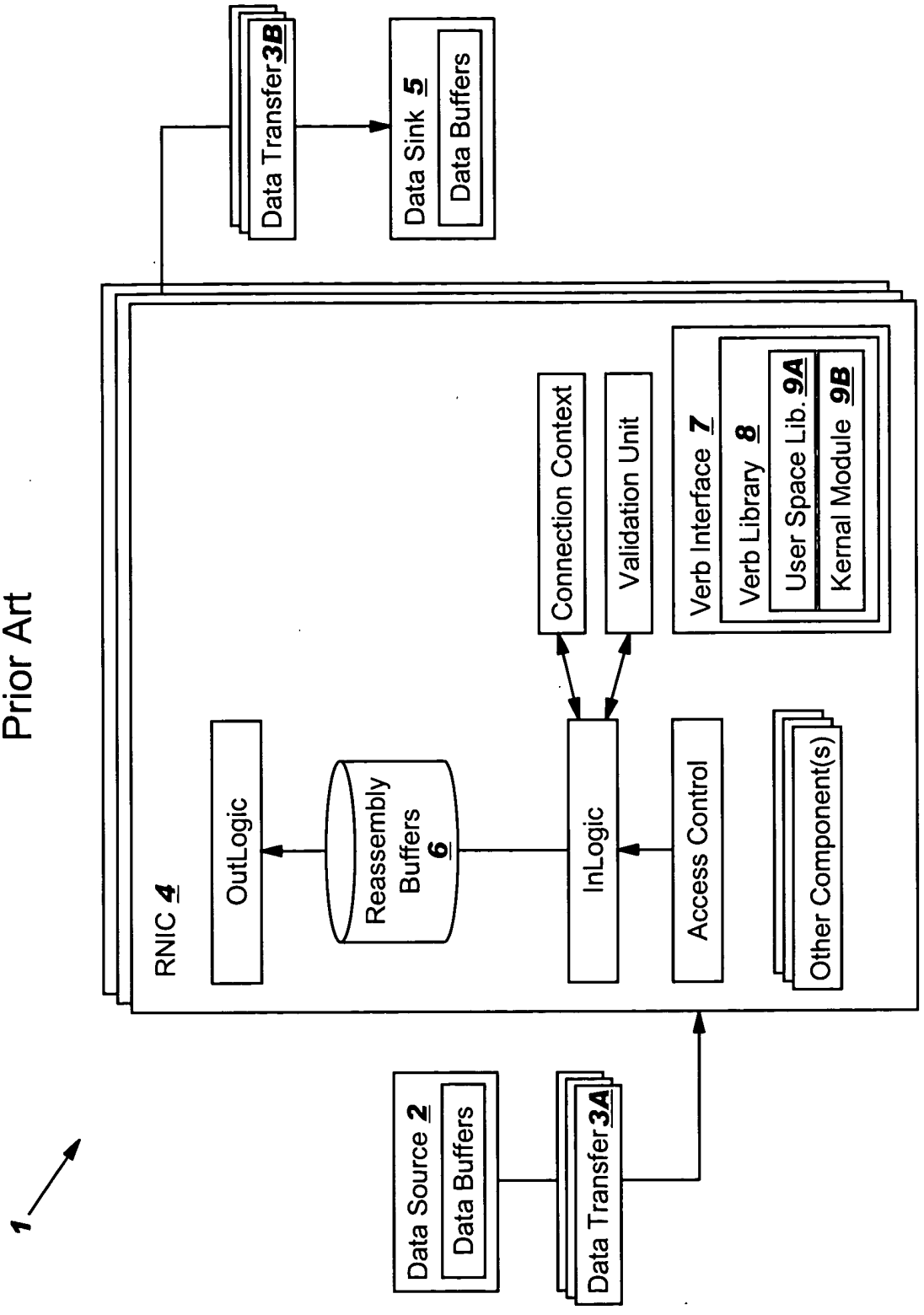
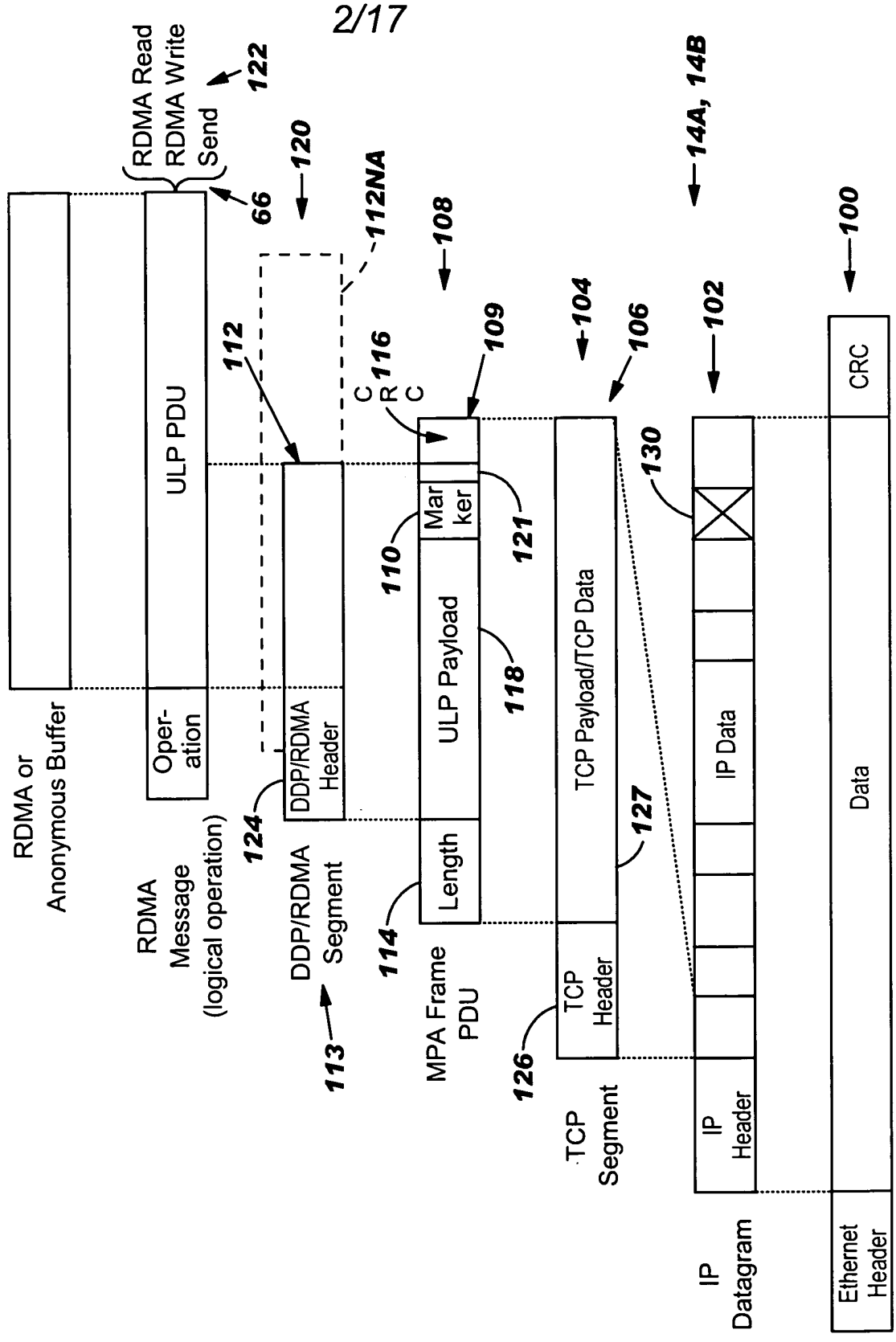


FIG. 1B
Prior Art



3/17

FIG. 1C

Prior Art

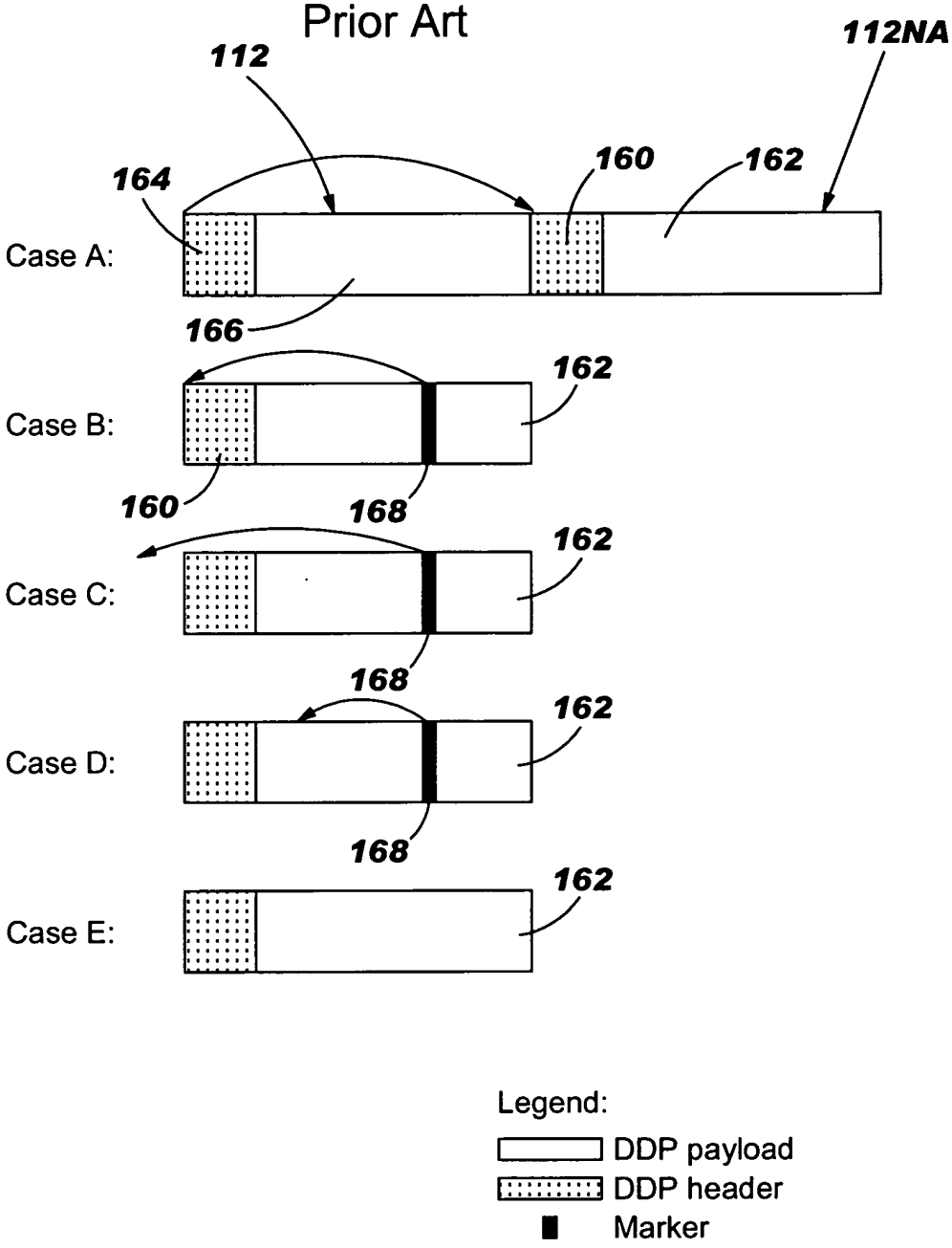


FIG. 1D
Prior Art

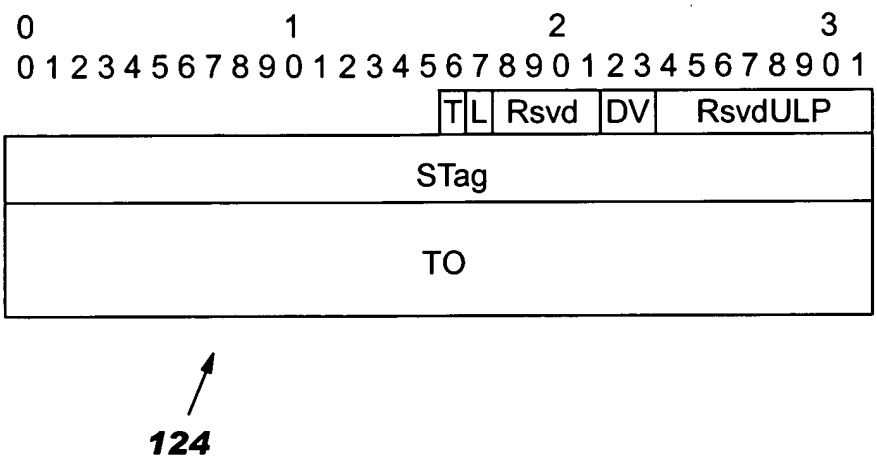
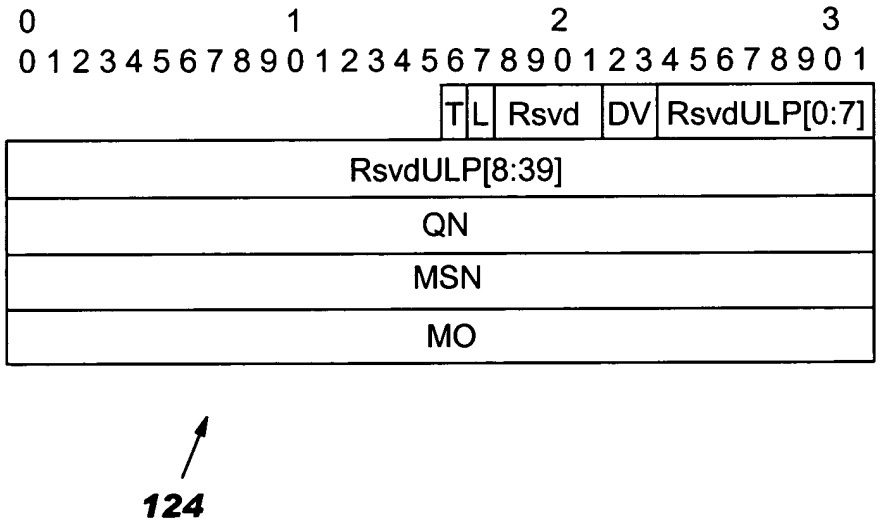


FIG. 1E
Prior Art



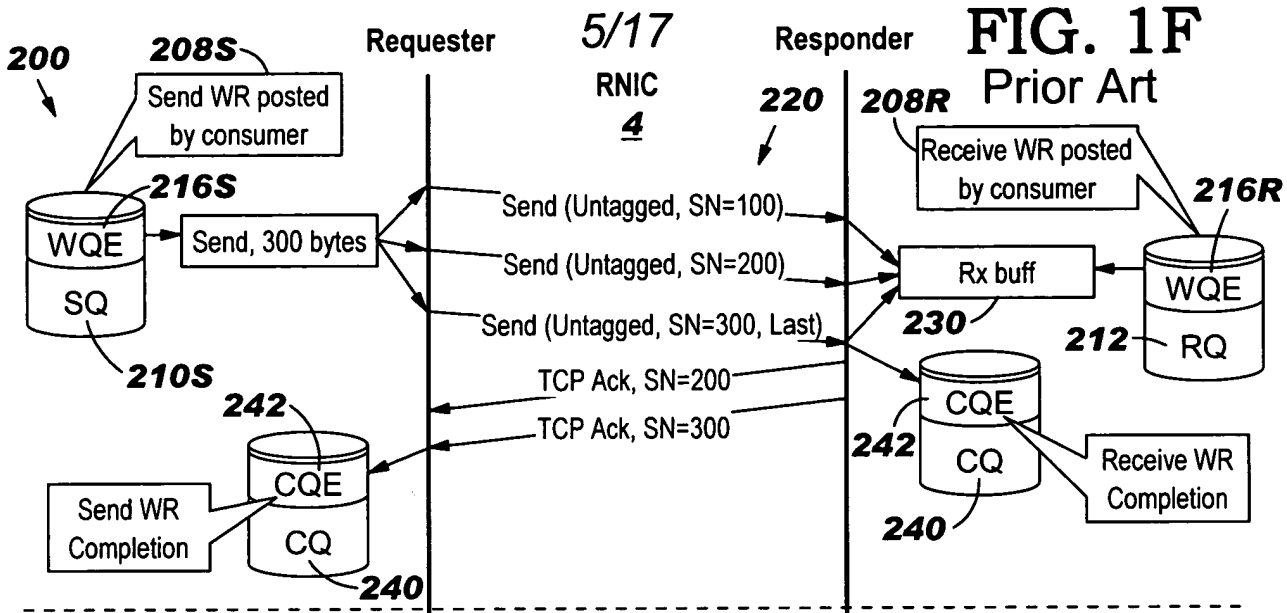


FIG. 1F
Prior Art

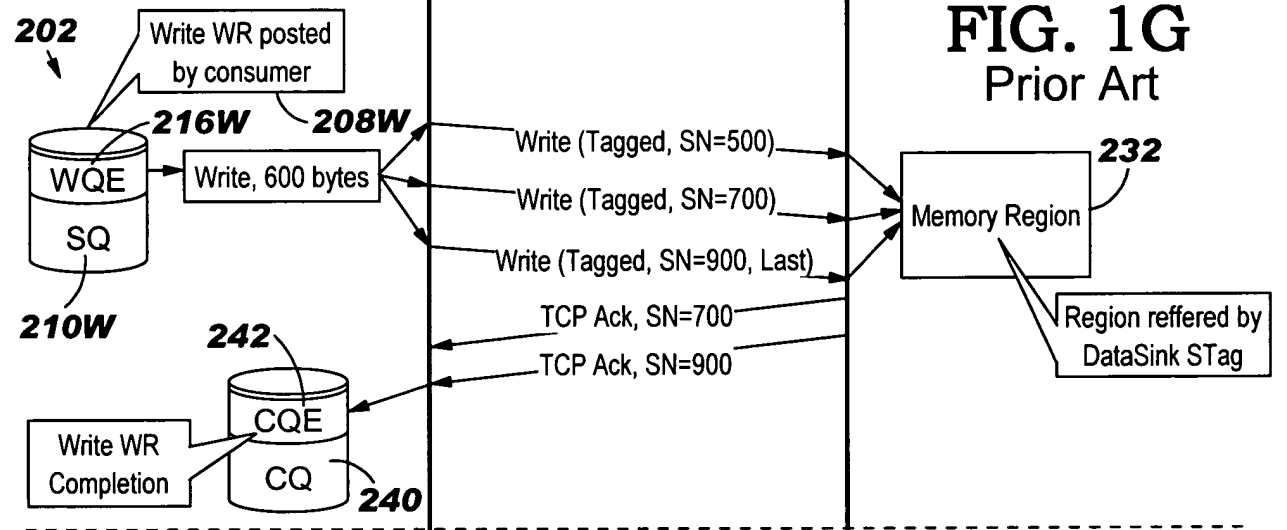


FIG. 1G
Prior Art

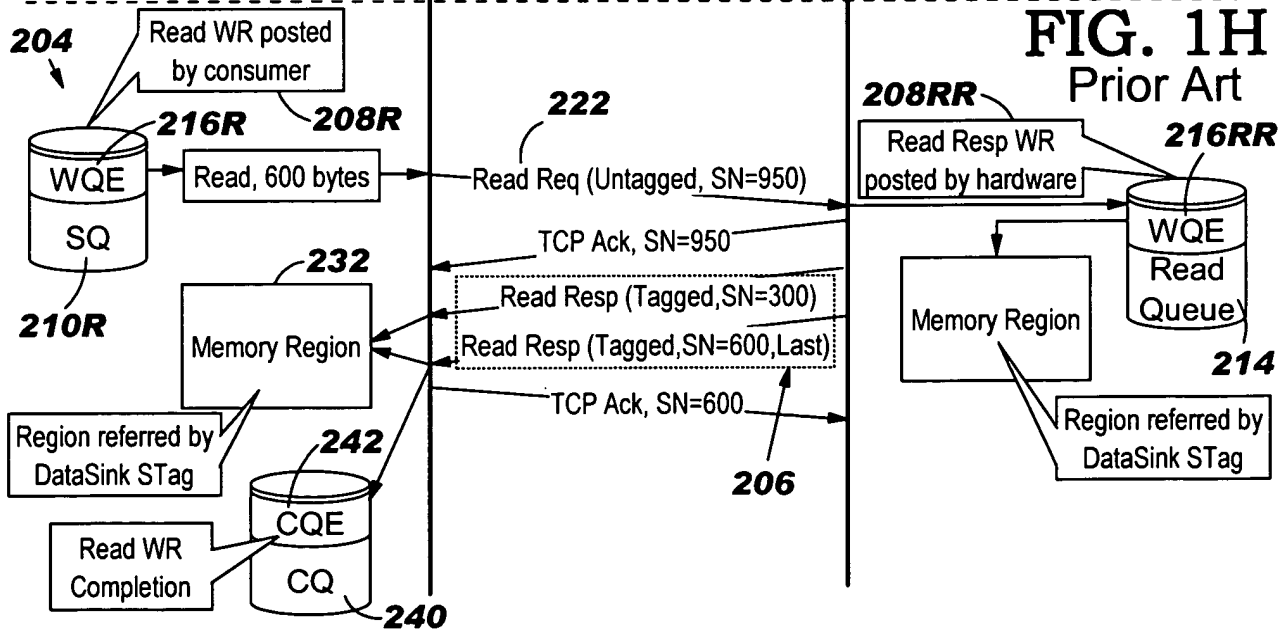


FIG. 1H
Prior Art

FIG. 2A

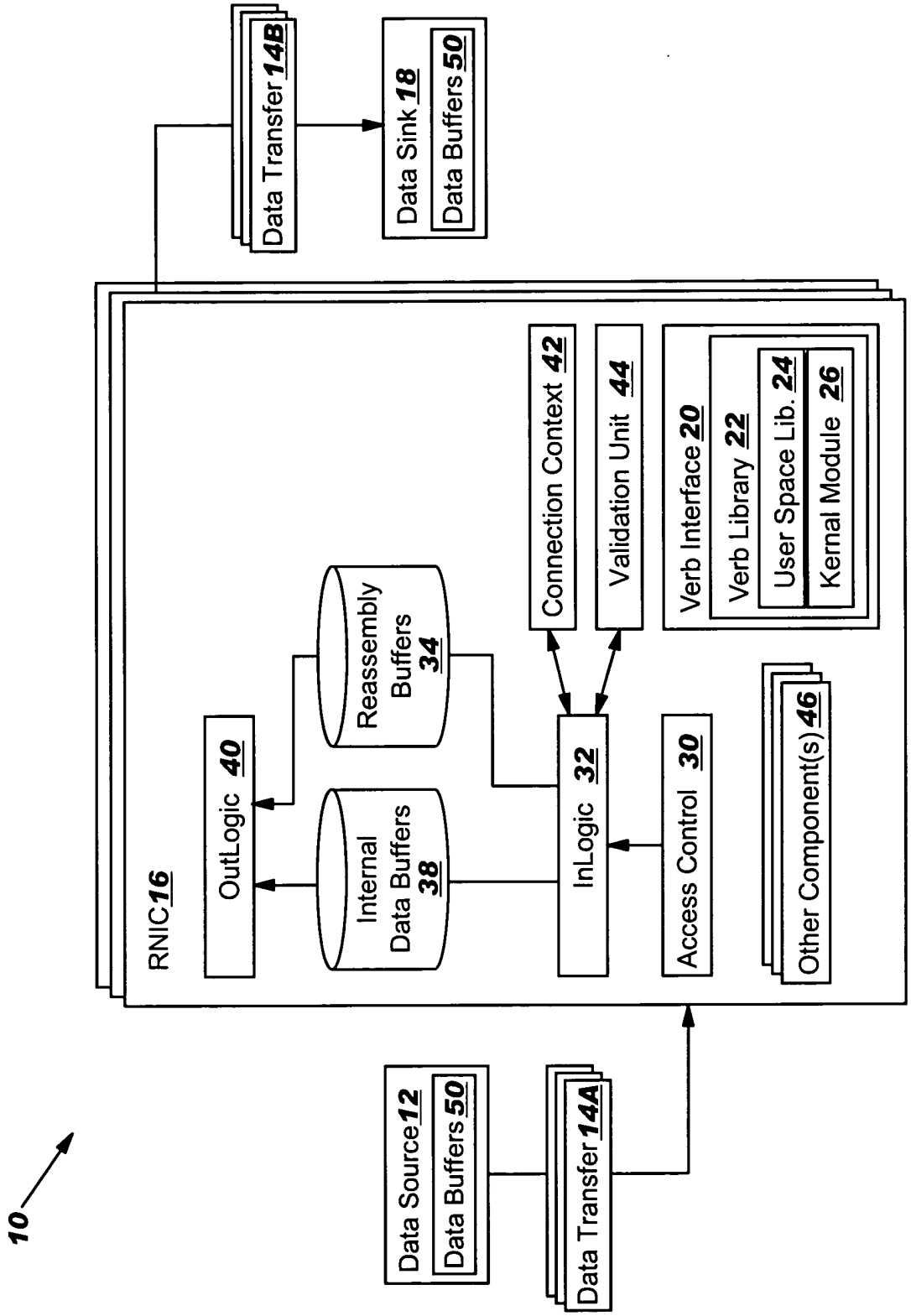

10
Data Source 12
Data Buffers 50
Data Transfer 14A
Data Transfer 14B
Data Sink 18
Data Buffers 50
RNIC 16
OutLogic 40
Internal Data Buffers 38
Reassembly Buffers 34
InLogic 32
Connection Context 42
Validation Unit 44
Access Control 30
Verb Interface 20
Verb Library 22
User Space Lib. 24
Kernal Module 26
Other Component(s) 46

FIG. 2C

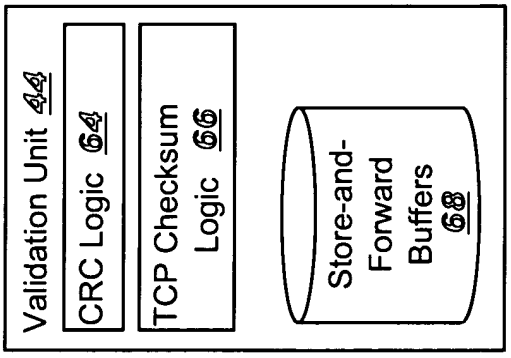

Validation Unit 44
CRC Logic 64
TCP Checksum Logic 66
Store-and-Forward Buffers 68

FIG. 2B

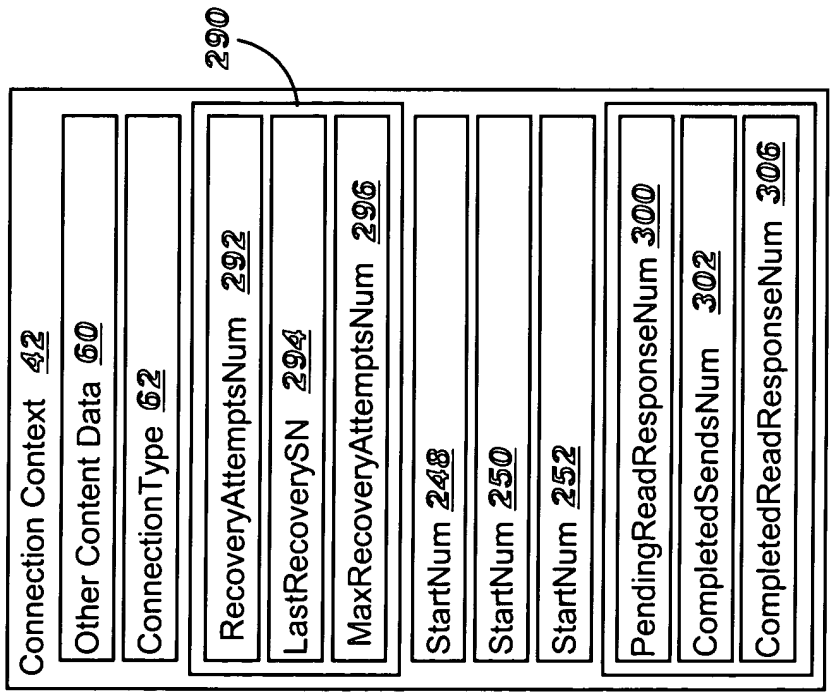

290
Connection Context 42
Other Content Data 60
ConnectionType 62
RecoveryAttemptsNum 292
LastRecoverySN 294
MaxRecoveryAttemptsNum 296
StartNum 248
StartNum 250
StartNum 252
PendingReadResponseNum 300
CompletedSendsNum 302
CompletedReadResponseNum 306

FIG. 3

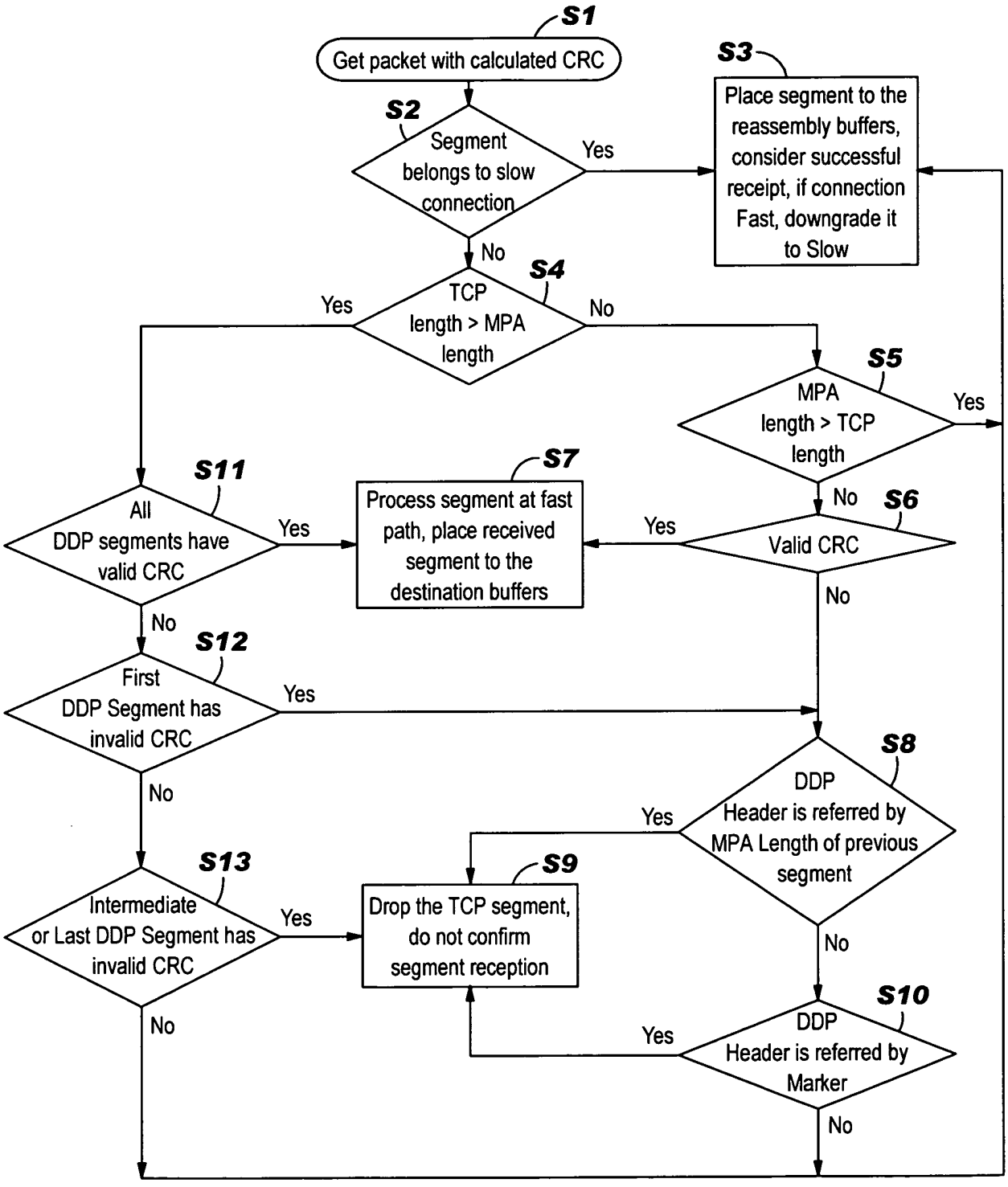

S1
Get packet with calculated CRC
S2
Segment belongs to slow connection
Yes
S3
Place segment to the reassembly buffers, consider successful receipt, if connection Fast, downgrade it to Slow
No
S4
TCP length > MPA length
Yes
No
S5
MPA length > TCP length
Yes
No
S6
Valid CRC
Yes
S7
Process segment at fast path, place received segment to the destination buffers
S11
All DDP segments have valid CRC
Yes
No
S12
First DDP Segment has invalid CRC
Yes
No
S8
DDP Header is referred by MPA Length of previous segment
Yes
No
S9
Drop the TCP segment, do not confirm segment reception
S10
DDP Header is referred by Marker
Yes
No
S13
Intermediate or Last DDP Segment has invalid CRC
Yes
No

FIG. 4A

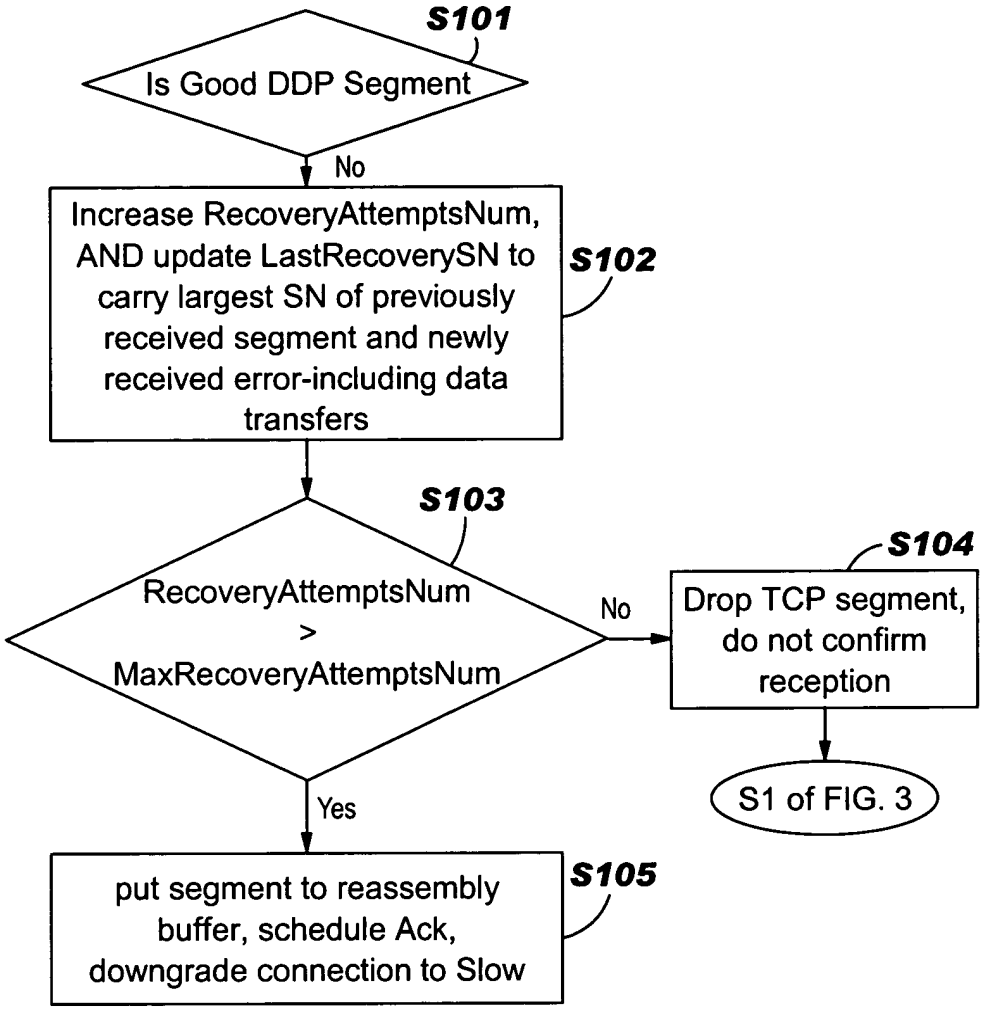

S101
Is Good DDP Segment
No
Increase RecoveryAttemptsNum, AND update LastRecoverySN to carry largest SN of previously received segment and newly received error-including data transfers
S102
S103
RecoveryAttemptsNum > MaxRecoveryAttemptsNum
No
S104
Drop TCP segment, do not confirm reception
S1 of FIG. 3
Yes
put segment to reassembly buffer, schedule Ack, downgrade connection to Slow
S105

FIG. 4B

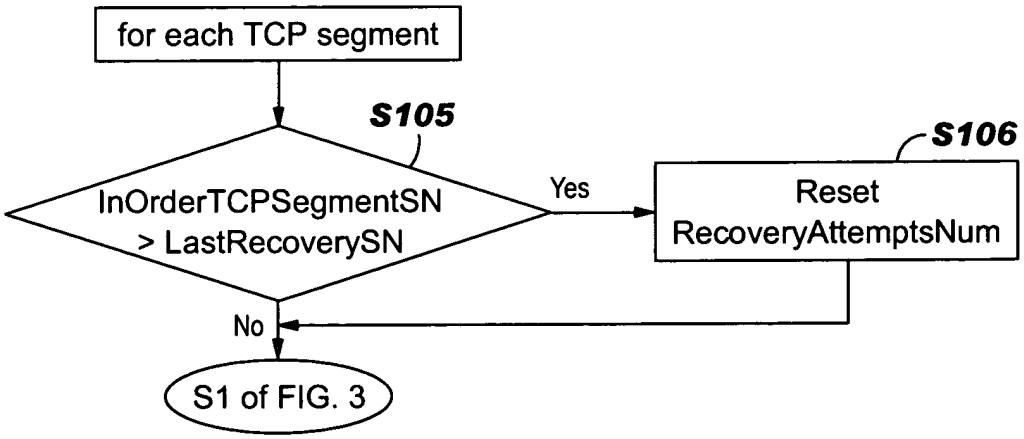

for each TCP segment
S105
InOrderTCPSegmentSN > LastRecoverySN
Yes
S106
Reset RecoveryAttemptsNum
No
S1 of FIG. 3

FIG. 5

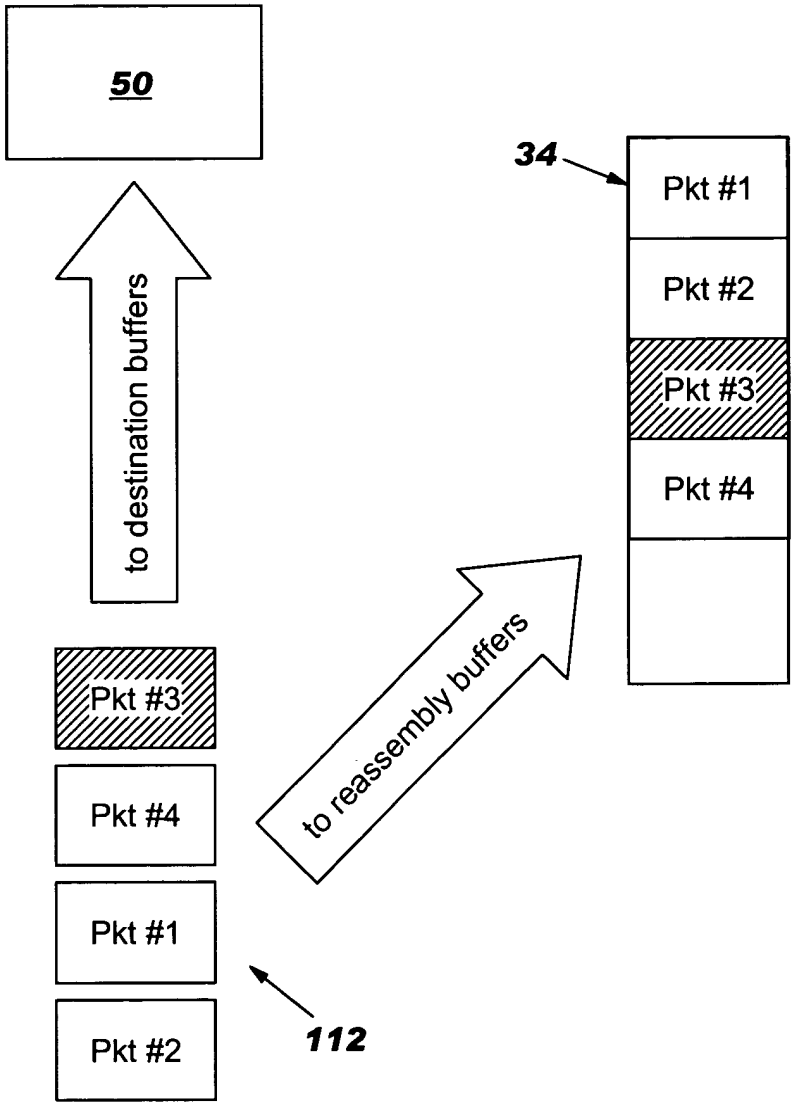

50
34
Pkt #1
Pkt #2
Pkt #3
Pkt #4
to destination buffers
to reassembly buffers
Pkt #3
Pkt #4
Pkt #1
Pkt #2
112

FIG. 6

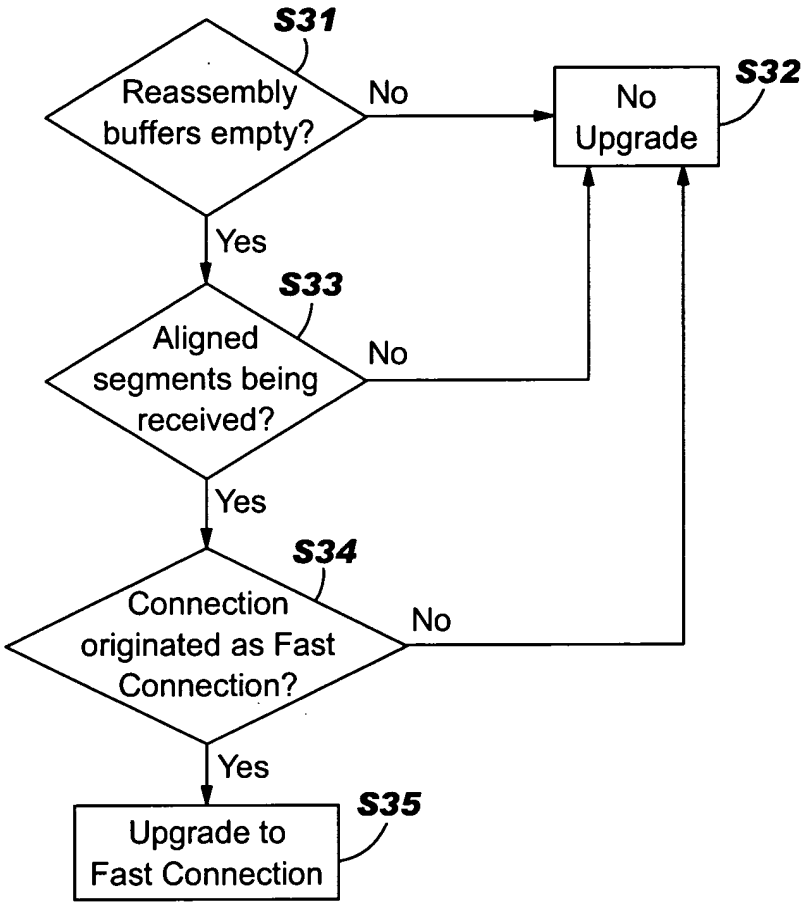

S31
Reassembly buffers empty?
No
S32
No Upgrade
Yes
S33
Aligned segments being received?
No
Yes
S34
Connection originated as Fast Connection?
No
Yes
S35
Upgrade to Fast Connection

FIG. 7

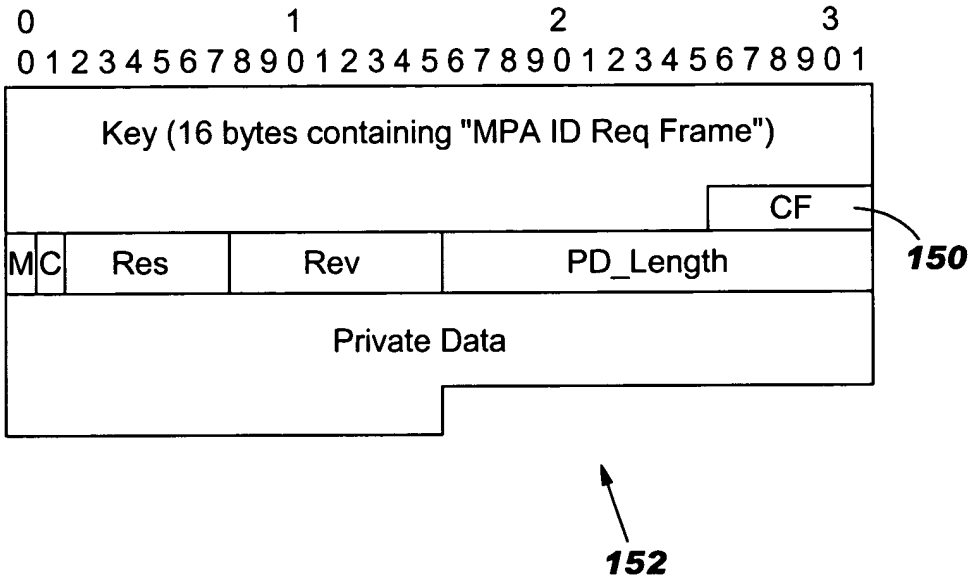

0 1 2 3
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
Key (16 bytes containing "MPA ID Req Frame")
CF
M
C
Res
Rev
PD_Length
150
Private Data
152

FIG. 8

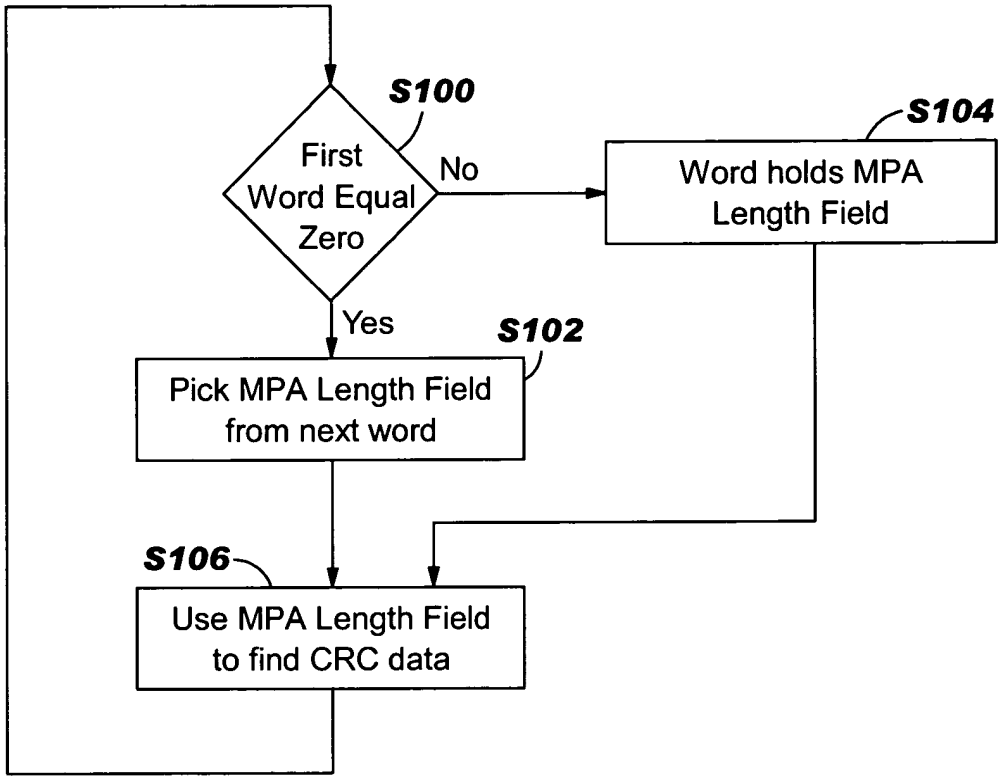

S100
First Word Equal Zero
No
S104
Word holds MPA Length Field
Yes
S102
Pick MPA Length Field from next word
S106
Use MPA Length Field to find CRC data

FIG. 9

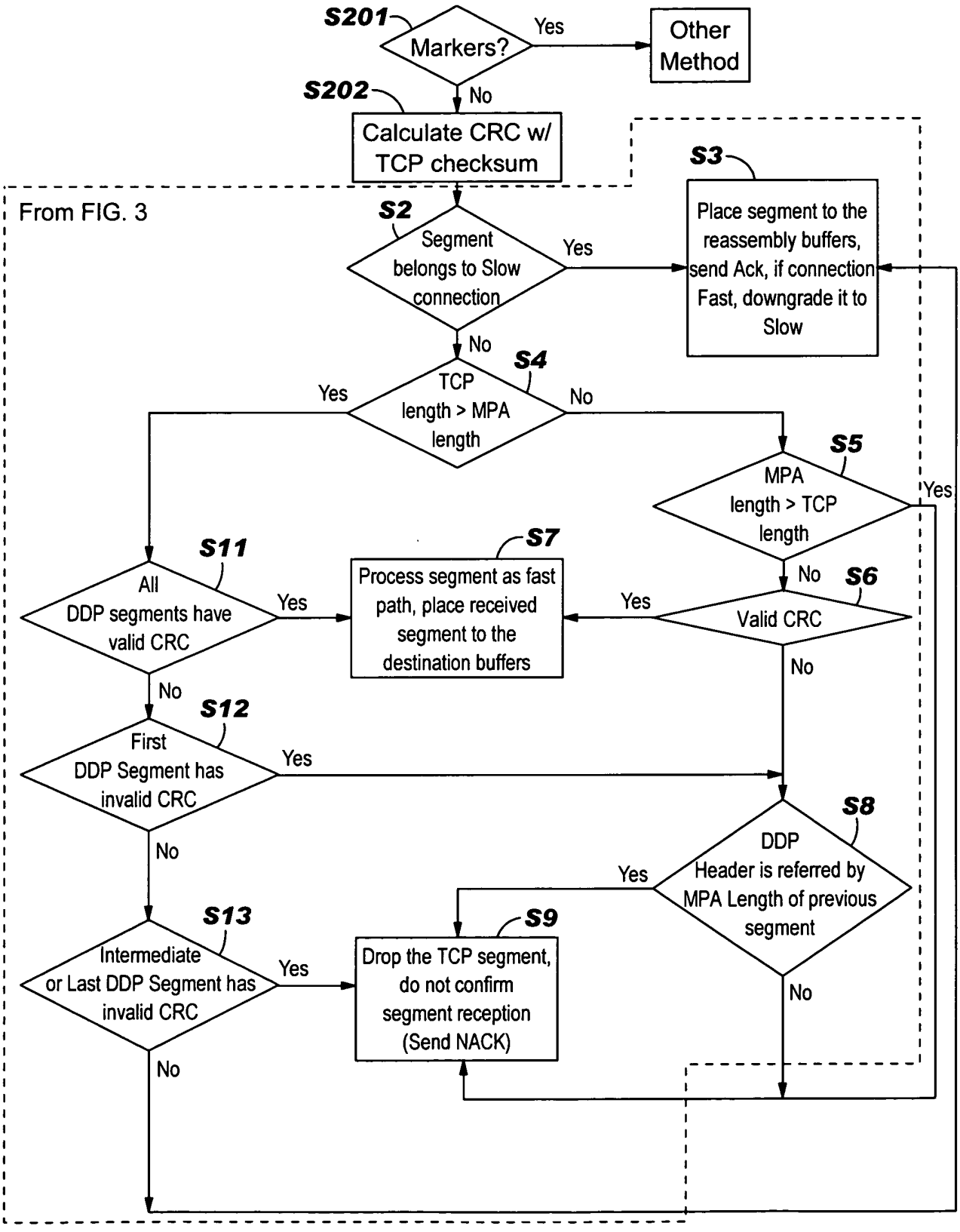

S201
Markers?
Yes
Other Method
No
S202
Calculate CRC w/ TCP checksum
From FIG. 3
S2
Segment belongs to Slow connection
Yes
S3
Place segment to the reassembly buffers, send Ack, if connection Fast, downgrade it to Slow
No
S4
TCP length > MPA length
Yes
No
S5
MPA length > TCP length
Yes
No
S6
Valid CRC
Yes
S7
Process segment as fast path, place received segment to the destination buffers
S11
All DDP segments have valid CRC
Yes
No
S12
First DDP Segment has invalid CRC
Yes
No
S8
DDP Header is referred by MPA Length of previous segment
Yes
No
S13
Intermediate or Last DDP Segment has invalid CRC
Yes
No
S9
Drop the TCP segment, do not confirm segment reception (Send NACK)

FIG. 10

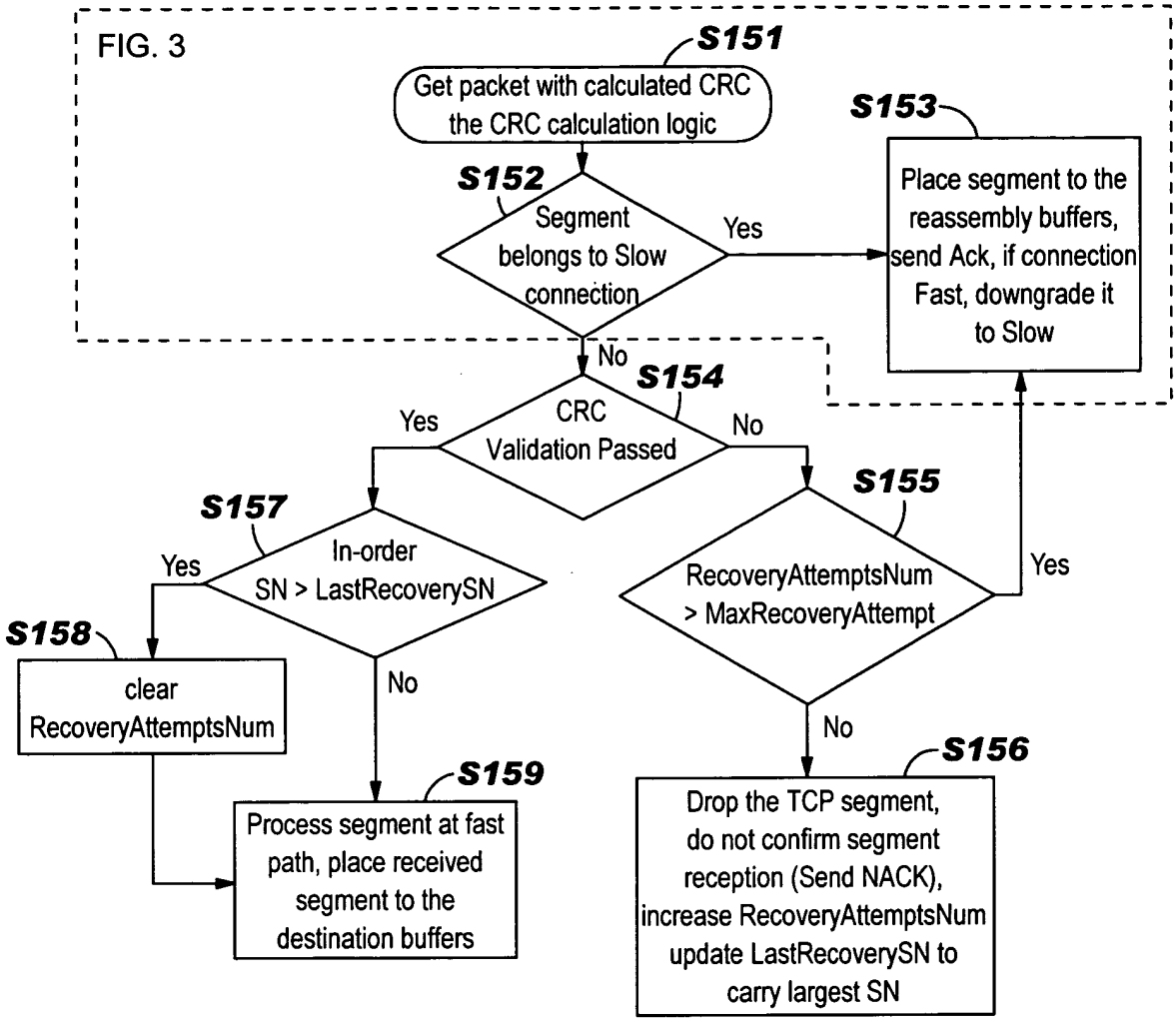


FIG. 3
S151
Get packet with calculated CRC the CRC calculation logic
S152
Segment belongs to Slow connection
Yes
S153
Place segment to the reassembly buffers, send Ack, if connection Fast, downgrade it to Slow
No
S154
CRC Validation Passed
Yes
No
S157
In-order SN > LastRecoverySN
Yes
S158
clear RecoveryAttemptsNum
No
S159
Process segment at fast path, place received segment to the destination buffers
S155
RecoveryAttemptsNum > MaxRecoveryAttempt
Yes
No
S156
Drop the TCP segment, do not confirm segment reception (Send NACK), increase RecoveryAttemptsNum update LastRecoverySN to carry largest SN

FIG. 11

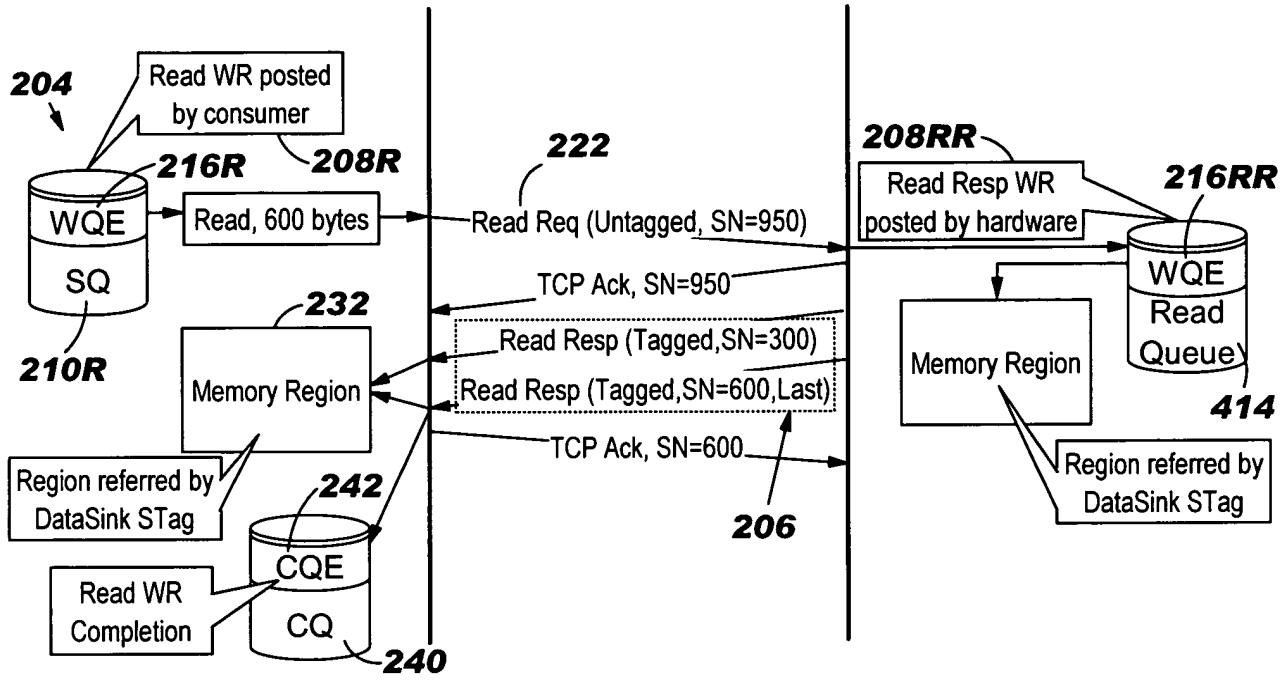

204
Read WR posted by consumer
216R
208R
222
208RR
Read Resp WR posted by hardware
216RR
WQE
SQ
Read, 600 bytes
Read Req (Untagged, SN=950)
TCP Ack, SN=950
WQE
Read Queue
414
210R
232
Memory Region
Read Resp (Tagged,SN=300)
Read Resp (Tagged,SN=600,Last)
Memory Region
TCP Ack, SN=600
Region referred by DataSink STag
242
206
Region referred by DataSink STag
CQE
Read WR Completion
CQ
240

FIG. 12

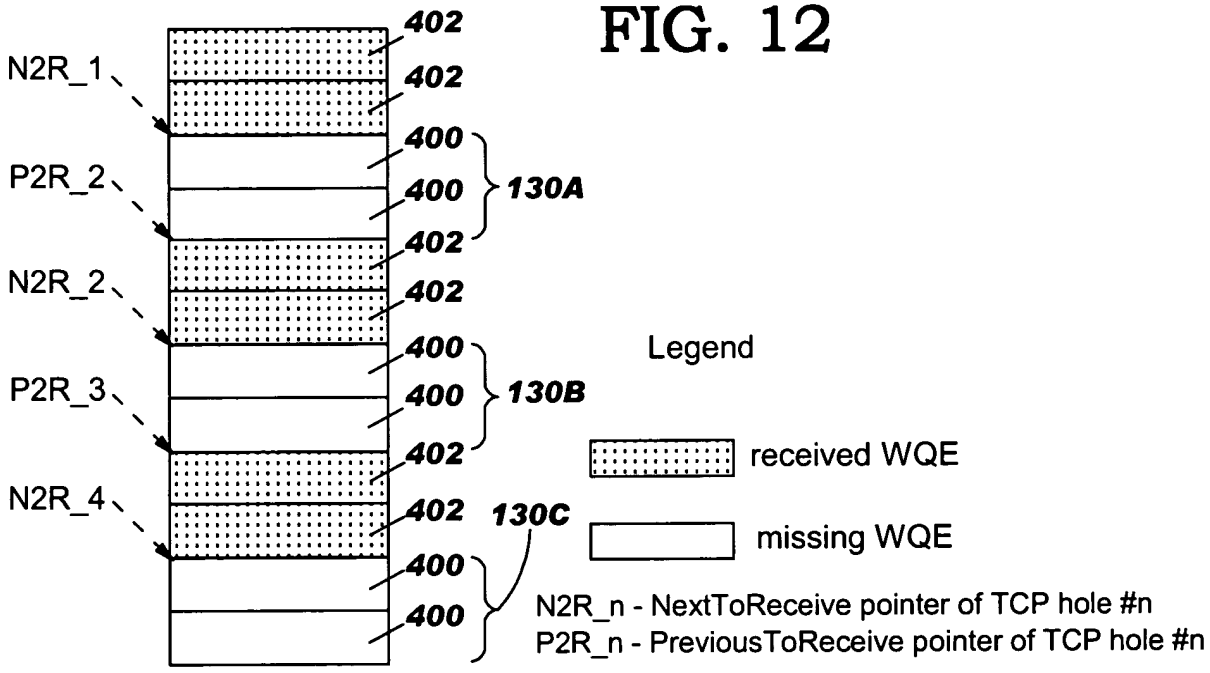


FIG. 13

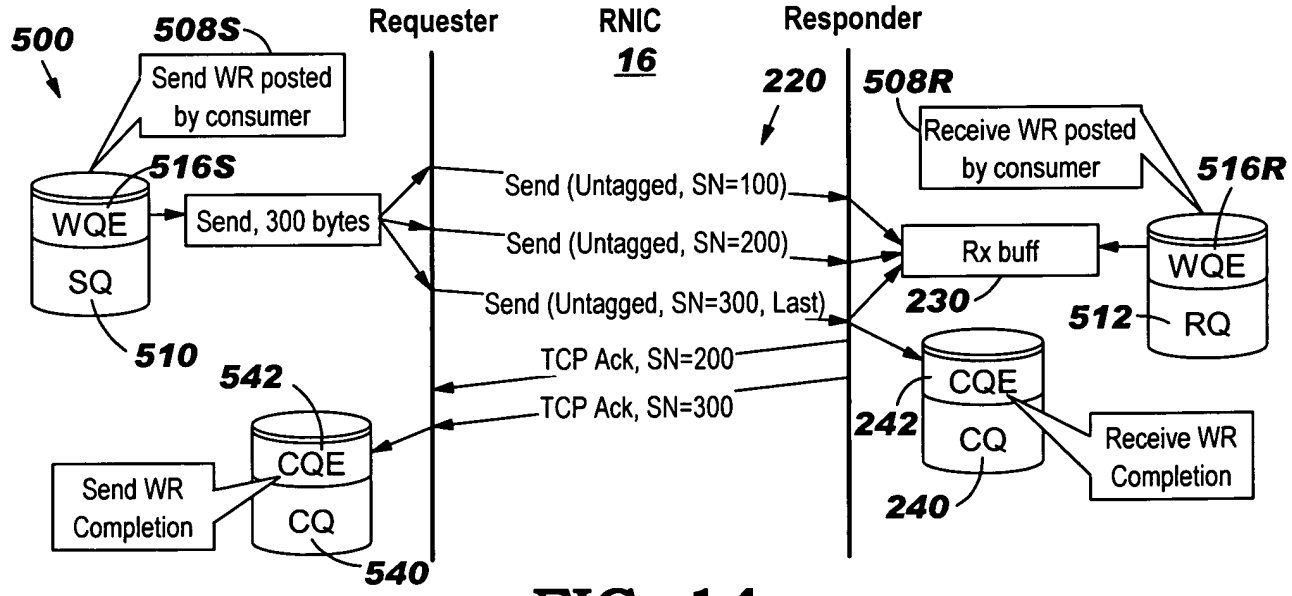
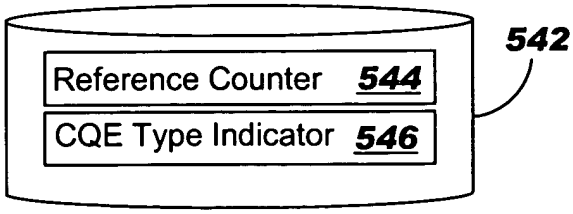



FIG. 14